

PRELIMINARY DATA SUMMARY

August 1987

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

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CERC Field Research Facility Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Field Research Facility Measurement and Analysis Work Unit at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility in Duck, North Carolina. The data were collected and the analyses performed by the FRF staff. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

CONTENTS

	Page
COVER	
TITLE PAGE	
TABLE OF CONTENTS	1
I INTRODUCTION	2
II METEOROLOGICAL DATA.	6
III WAVE DATA.	9
IV CURRENT DATA	13
V SUPPLEMENTAL OBSERVATIONS.	21
VI WATER LEVELS	23
VII NEARSHORE PROFILES AND BATHYMETRY.	26
VIII SPECIAL EVENTS	29

FIGURES

1 LOCATION MAP	3
2 INSTRUMENT LOCATIONS	5
3 TIME HISTORY OF WAVE HEIGHTS AND PERIODS	12
4 WATER LEVEL TIME HISTORY	24
5 CRAB PROFILES.	26
6 CRAB PROFILE ENVELOPE.	27
7 FRF CONTOUR DIAGRAM.	28

TABLES

1 INSTRUMENT STATUS/DATA AVAILABILITY.	4
2 METEOROLOGICAL DATA.	7
3 WAVE DATA.	10
4 CURRENT DATA	14
5 SUPPLEMENTAL OBSERVATIONS.	22
6 TIDAL CHARACTERISTICS.	25

I. INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Fig.1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The FRF consists of a 561-m (1,840 ft) long concrete research pier supported on 0.91 m (3 ft) diameter steel piles. The pier deck is 6.1 m (20 ft) wide, 7.74 m (25.4 ft) above mean sea level (MSL), and extends from behind the dunes to approximately the 7.6 m (25 ft) depth contour. In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Most of the data are daily observations or the results of preliminary data analysis. In many instances, continuous analog records and more extensive analyses will be made available later by the CERC Coastal Engineering Information and Analysis Center (CEIAC).

Table 1 is a list of instruments used, their status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depth at the wave gages and current meters vary and may best be determined from the information contained in Figure 8. Other installation information is contained in Table 1. All times unless otherwise specified are referenced to Eastern Standard Time (EST).

Section II presents the meteorological data; Sections III through VI, oceanographic data; Section VII, nearshore profiles and bathymetry; and Section VIII, if included, documents special events that occurred at the FRF during the month.

Questions and/or comments concerning the data may be directed to Mr. Herman C. Miller at (919) 261-3511.

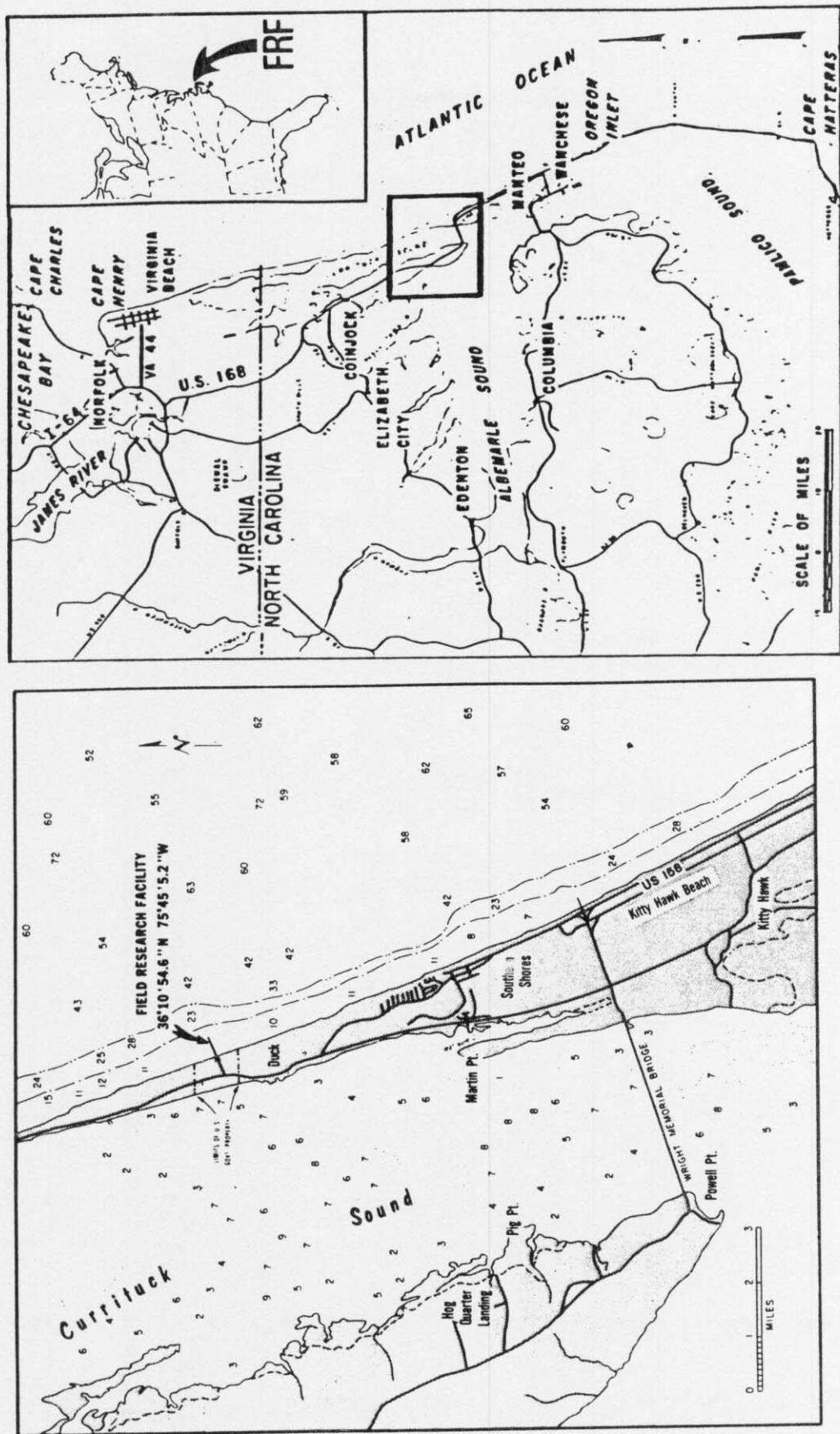


Figure 1. FRF location map.

GAGE NUMBER	DESCRIPTION/REMARKS	DEPTH AT SENSOR	DAY OF THE MONTH																																						
			1/2/3/4/5/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/29/30/31																																						
	Barometric Pressure		Instrument Status																																						
		Data Collected	YES <input checked="" type="checkbox"/>																																						
		Analog Record	NO <input type="checkbox"/>																																						
		Instrument Status																																							
	Precipitation	Data Collected	YES <input checked="" type="checkbox"/>																																						
		Analog Record	NO <input type="checkbox"/>																																						
		Instrument Status																																							
	Air Temperature	Data Collected	YES <input checked="" type="checkbox"/>																																						
		Maximum/Minimum																																							
		Instrument Status																																							
	Anemometer on Lab Bldg -	Data Collected	YES <input checked="" type="checkbox"/>																																						
	Elevation 19m (NGVD)	Analog Record	NO <input type="checkbox"/>																																						
		Instrument Status																																							
	Baylor staff located at sta-	Data Collected	YES <input checked="" type="checkbox"/>																																						
	tion 6+80 on FRF pier	Instrument Status																																							
		Data Collected	YES <input checked="" type="checkbox"/>																																						
	Baylor staff located at	Instrument Status																																							
	station 19+00 on FRF pier	Data Collected	YES <input checked="" type="checkbox"/>																																						
		Instrument Status																																							
	Pressure gage located 440 m	Data Collected	YES <input checked="" type="checkbox"/>																																						
	north of FRF pier (0.9 km	Instrument Status																																							
	(offshore)	Data Collected	YES <input checked="" type="checkbox"/>																																						
		Instrument Status																																							
	Waverider buoy located 6.0km	NO <input type="checkbox"/>																																							
	from shore	NGVD																																							
		Instrument Status																																							
		Data Collected	YES <input checked="" type="checkbox"/>																																						
		Instrument Status																																							
	Current meter 500m south	NO <input type="checkbox"/>																																							
	(0.5km offshore)	NGVD																																							
		Instrument Status																																							
		Data Collected	YES <input checked="" type="checkbox"/>																																						
	NOAA primary tide station																																								
	located at seaward end of FRF																																								
	pier.																																								

Instrument Status: Operational - Daily Observation: YES , PARTIAL
 Analog Record: ALL , PARTIAL
 Data Collected: All , SOME

Preliminary Analysis: ALL , SOME

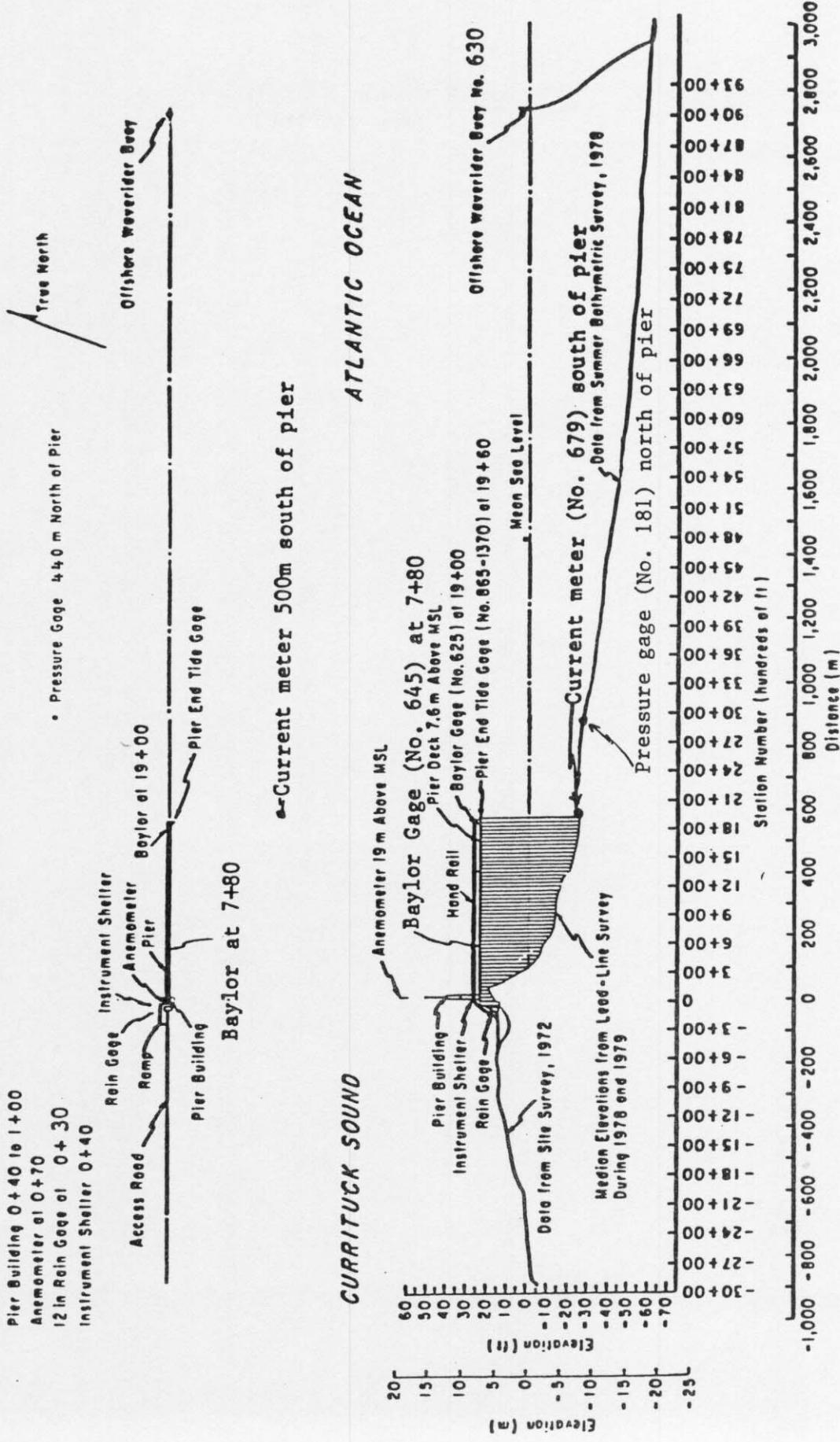


Figure 2. Instrument locations at FRF.

II. METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Fig. 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

The wind measurements are obtained from a Weather Measure Skyvane located on the FRF laboratory building (Fig. 2), 19.1 m above mean sea level (MSL).

The high and low temperatures are obtained from daily readings of NWS maximum and minimum thermometers and represent the extreme temperature values since the last reading.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in) -
 $mm \times .03937 = in$
2. Millibars (mb) to inches of mercury (in Hg) -
 $mb \times 0.02953 = in Hg$
3. Degrees Celcius (C) to degrees Fahrenheit (F) -
 $(C \times 9/5) + 32 = F$
4. Meters per second (m/s) to knots (kn) -
 $m/s \times 1.943 = kn$

TABLE 2: Meteorological Data

AUG 1987

Day	Hour	Wind Speed (m/s)	Wind Direction (deg TN)	Temperature (deg C)	Atm Pressure (mb)	Precipitation (mm)
1	100	5	235	26.3	1013.5	0
	700	1	11	24.3	1013.5	0
	1300	5	124	29.5	1012.8	0
	1900	2	183	23.6	1013.8	0
2	100	3	151	23.0	1013.1	0
	700	3	127	25.7	1013.8	0
	1300	5	115	28.9	1013.5	0
	1900	4	144	25.5	1012.1	0
3	100	5	227	26.3	1012.1	0
	700	6	239	27.1	1011.4	0
	1300	5	228	32.5	1010.4	0
	1900	5	203	30.0	1009.1	0
4	100	4	242	27.7	1010.1	0
	700	5	236	27.2	1009.4	0
	1300	4	238	32.4	1008.7	0
	1900	5	302	26.3	1009.4	0
5	100	4	239	25.8	1008.1	0
	700	2	280	26.9	1009.1	0
	1300	4	120	30.8	1008.7	0
	1900	5	19	24.6	1008.1	0
6	100	4	272	25.2	1009.8	2
	700	4	318	25.3	1012.1	0
	1300	5	10	28.5	1014.2	0
	1900	4	352	25.8	1015.2	0
7	100	6	59	25.5	1016.9	0
	700	4	64	26.3	1018.2	0
	1300	3	60	28.1	1017.5	0
	1900	4	68	25.3	1017.2	0
8	100	3	116	24.7	1016.9	0
	700	3	22	26.1	1017.2	0
	1300	3	103	29.3	1016.9	0
	1900	4	20	25.8	1015.2	0
9	100	4	216	26.2	1015.2	0
	700	5	231	26.8	1015.2	0
	1300	4	190	31.4	1014.2	0
	1900	7	204	28.2	1012.5	0
10	100	10	224	26.3	1011.1	0
	700	8	227	26.7	1010.8	7
	1300	5	244	32.1	1009.8	0
	1900	2	143	24.9	1009.4	0
11	100	4	317	25.6	1011.1	0
	700	8	33	22.6	1013.5	0
	1300	7	28	25.2	1014.8	0
	1900	8	55	24.1	1013.5	0
12	100	8	58	23.4	1013.8	0
	700	9	55	24.0	1014.5	0
	1300	9	58	25.8	1015.5	0
	1900	8	54	24.3	1016.5	0
13	100	7	60	24.1	1017.2	0
	700	8	59	24.5	1017.9	0
	1300	9	49	24.5	1019.6	0
	1900	7	57	23.3	1019.6	0
14	100	8	26	23.6	1018.9	0
	700	10	32	24.0	1018.9	0
	1300	6	52	26.0	1019.6	0
	1900	7	65	25.0	1017.9	0
15	100	9	83	24.7	1017.9	0
	700	8	86	25.5	1017.5	0
	1300	11	85	24.0	1017.2	6
	1900	7	102	24.7	1016.2	3
16	100	4	129	24.5	1015.9	0
	700	2	118	25.4	1016.5	0
	1300	4	126	30.2	1016.2	0
	1900	4	169	27.1	1014.8	0

TABLE 2: Meteorological Data

AUG 1987

Day	Hour	Wind Speed (m/s)	Wind Direction (deg TN)	Temperature (deg C)	Atm Pressure (mb)	Precipitation (mm)
17	100	5	230	26.1	1014.8	0
	700	4	250	26.9	1016.2	0
	1300	4	220	31.7	1014.8	0
	1900	5	197	28.8	1012.5	0
18	100	6	233	27.0	1013.5	0
	700	5	234	27.8	1013.5	0
	1300	4	100	32.1	1013.5	0
	1900	3	43		1012.8	0
19	100	2	7		1013.5	0
	700	2	53	Gage	1013.8	0
	1300	4	76	Inoperative	1014.2	30
	1900	2	152		1014.2	5
20	100	3	280		1015.5	0
	700	4	318		1017.2	0
	1300	5	16	27.8	1018.6	0
	1900	2	63	25.5	1019.6	0
21	100	0		23.1	1020.9	0
	700	2	315	24.8	1023.3	0
	1300	4	77	28.8	1024.0	0
	1900	3	108	25.7	1022.6	0
22	100	3	170	24.2	1022.6	0
	700	5	231	25.8	1021.6	0
	1300	7	216	30.0	1018.2	0
	1900	7	212	27.7	1015.5	0
23	100	8	239	26.2	1014.8	0
	700	5	266	26.0	1014.8	0
	1300	6	349	24.7	1017.2	0
	1900	8	21	24.0	1018.9	0
24	100	4	34	23.3	1020.9	0
	700	9	25	23.3	1022.6	0
	1300	6	23	23.2	1024.0	0
	1900	5	56	21.6	1023.6	0
25	100	4	100	21.8	1024.7	0
	700	5	99	23.8	1025.0	0
	1300	7	133	27.0	1024.3	0
	1900	3	190	24.7	1023.0	0
26	100	1	201	24.1	1023.0	0
	700	4	344	24.0	1022.6	0
	1300	4	69	24.4	1023.0	0
	1900	4	107	23.8	1021.3	0
27	100	3	280	24.3	1020.3	0
	700	6	230	25.8	1019.9	0
	1300	5	237	32.0	1017.5	0
	1900	4	193	28.8	1016.2	0
28	100	6	230	25.0	1017.2	0
	700	6	232	26.5	1017.5	0
	1300	4	254	31.9	1016.5	0
	1900	3	187	30.0	1015.9	0
29	100	6	250	27.3	1016.2	0
	700	7	249	26.8	1016.9	0
	1300	5	21	27.9	1017.9	0
	1900	5	76	25.2	1018.6	0
30	100	6	38	25.3	1019.6	0
	700	10	34	23.0	1021.6	0
	1300	8	35	23.5	1022.6	0
	1900	5	73	22.7	1021.9	0
31	100	4	86	23.4	1020.9	0
	700	7	86	24.1	1020.3	0
	1300	6	134	27.0	1018.2	0
	1900	2	231	24.9	1015.9	0

III. WAVE DATA

Wave data are collected from two Baylor staff gages (Gages 625 and 645), a pressure wave gage (Gage 181) and a Waverider buoy (Gage 630) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 6 hrs near 0100, 0700, 1300, and 1900 EST. The sampling rate is two times per second for 34 minutes.

Wave height (H_{mo}) is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. Wave height reported from the pressure gage has been compensated for hydrodynamic attenuation using linear wave theory. The wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. The period (T_p) is that associated with the maximum energy density in the spectrum. When this analysis is complete, the data are written to magnetic tape.

Table 3 presents the wave heights and periods for each wave record obtained during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed for all data records collected. Figure 3 is a time history of the H_{mo} and T_p values for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, or the presence of multiple wave trains containing nearly equal energy.

TABLE 3: WAVE DATA

Part 1

AUG 1987

Day	Hour	645		625		181		630	
		Baylor Hmo(m)	at 7+80 T(sec)	Baylor Hmo(m)	at 19+00 T(sec)	Pressure Hmo(m)	Gage T(sec)	Farshr Hmo(m)	Wvldr T(sec)
1	0100	0.23	15.06	0.41	14.22	0.55	14.22	0.55	8.53
	0700	0.29	14.22	0.46	8.53	0.58	14.22	0.52	8.26
	1300	0.39	14.22	0.54	13.48	0.59	14.22	0.58	8.53
	1900	0.36	4.74	0.56	8.83	0.63	13.48	0.61	8.00
2	0100	0.43	4.57	0.56	8.83	0.62	13.48	0.63	8.83
	0700	0.50	4.57	0.64	5.22	0.57	8.83	0.71	5.02
	1300	0.51	5.56	0.66	5.33	0.59	5.22	0.70	5.69
	1900	0.40	5.45	0.69	5.45	0.60	5.45	0.76	5.12
3	0100	0.40	4.57	0.65	8.83	0.66	8.83	0.76	8.53
	0700	0.27	9.48	0.50	9.14	0.63	8.83	0.58	8.83
	1300	0.28	9.48	0.50	9.14	0.62	9.48	0.56	9.14
	1900	0.30	9.14	0.51	9.14	0.56	9.14	0.68	9.14
4	0100	0.28	8.83	0.44	8.83	0.52	9.48	0.68	8.83
	0700	0.27	9.14	0.43	9.84	0.47	9.14	0.58	9.84
	1300	0.30	9.14	0.46	9.14	0.58	9.14	0.65	9.48
	1900	0.34	9.14	0.50	9.14	0.59	9.14	0.70	9.14
5	0100	0.28	8.83	0.44	8.83	0.51	9.14	0.65	8.53
	0700	0.29	6.74	0.47	8.83	0.55	6.24	0.69	6.74
	1300	0.39	5.69	0.51	6.40	0.54	6.40	0.65	5.33
	1900	0.29	8.83	0.41	8.00	0.46	8.83	0.55	8.53
6	0100	0.30	5.02	0.45	8.83	0.47	8.83	0.54	6.92
	0700	0.30	9.14	0.43	9.14	0.48	8.53	0.59	9.14
	1300	0.38	6.92	0.50	8.83	0.53	8.26	0.62	7.11
	1900	0.46	3.41	0.58	3.51	0.50	3.41	0.74	3.28
7	0100	1.02	5.56	0.99	5.56	0.70	5.33	1.11	5.69
	0700	0.81	6.74	0.82	6.57	0.72	6.74	0.97	6.92
	1300	0.76	6.09	0.87	6.57	0.78	6.74	0.94	6.92
	1900	0.67	6.09	0.76	7.11	0.67	6.57	0.85	6.57
8	0100	0.49	6.09	0.72	6.74	0.68	6.40	0.83	6.74
	0700	0.50	6.57	0.71	8.53	0.63	6.40	0.70	6.40
	1300	0.42	5.82	0.57	5.95	0.58	6.09	0.63	6.40
	1900	0.40	5.56	0.56	8.26	0.49	8.00	0.57	7.76
9	0100	0.24	7.53	0.44	7.53	0.48	7.53	0.51	6.92
	0700	0.21	8.26	0.40	7.53	0.44	8.26	0.53	8.83
	1300	0.21	9.14	0.40	8.53	0.45	8.83	0.50	8.53
	1900	0.33	14.22	0.46	8.83	0.45	3.46	0.74	3.82
10	0100	0.20	8.53	0.33	8.53	0.38	8.83	0.65	2.56
	0700	0.18	13.48	0.33	7.76	0.34	8.53	0.49	2.31
	1300	0.19	15.06	0.28	7.76	0.34	12.80	0.34	8.53
	1900	0.27	15.06	0.32	13.48	0.37	14.22	0.42	13.48
11	0100	0.20	13.48	0.27	13.48	0.35	13.48	0.34	7.53
	0700	1.31	5.33	1.27	5.33	0.87	5.22	1.46	5.45
	1300	1.22	5.82	1.16	5.45	0.86	5.56	1.27	5.56
	1900	1.02	6.09	1.06	5.12	0.83	5.82	1.22	6.09
12	0100	1.05	5.82	1.05	5.69	0.81	5.45	1.15	4.92
	0700	1.03	5.69	1.18	5.56	0.90	4.74	1.34	5.56
	1300	0.95	5.33	1.18	5.22	0.97	5.56	1.31	5.22
	1900	0.94	5.56	1.50	5.95	1.35	5.82	1.63	6.57
13	0100	0.85	4.66	1.36	6.57	1.20	6.09	1.46	6.74
	0700	0.84	7.76	1.28	7.11	1.28	7.53	1.52	7.53
	1300	1.01	5.82	1.53	7.76	1.48	8.00	1.74	7.53
	1900	0.89	9.14	1.36	9.14	1.34	7.53	1.56	7.11
14	0100	0.90	11.64	1.30	11.64	1.31	8.83	1.39	11.64
	0700	1.15	12.20	1.69	11.64	1.67	12.20	1.72	5.95
	1300	1.17	12.20	1.55	12.20	1.64	11.64	1.68	9.84
	1900	1.44	11.64	2.36	11.64	2.24	11.14	1.84	9.48
15	0100	1.37	12.20	*	2.39	11.64	2.01	11.14	
	0700	1.50	11.14	*	2.60	11.14	2.13	11.14	
	1300	1.52	11.64	*	2.32	11.14	2.29	11.14	
	1900	1.41	8.26	*	2.25	10.66	1.95	8.00	
16	0100	0.99	6.74	1.67	10.24	1.83	10.66	1.73	10.66
	0700	0.86	11.64	1.57	11.14	1.49	9.84	1.40	10.24
	1300	0.65	11.14	1.47	11.14	1.29	10.66	1.32	9.84
	1900	0.55	10.24	1.25	9.84	1.30	10.66	1.01	9.48

* Electronic problems

TABLE 3: WAVE DATA

Part 2

AUG 1987

Day	Hour	645		625		181		630	
		Baylor Hmo(m)	T(sec)	Baylor Hmo(m)	T(sec)	Pressure Hmo(m)	Gage T(sec)	Farsh Hmo(m)	Wvldr T(sec)
17	0100	0.41	10.24	1.02	11.14	1.11	9.84	0.90	9.48
	0700	0.43	11.64	1.07	11.14	1.03	11.14	0.80	8.26
	1300	0.40	11.64	0.89	10.66	1.07	11.64	0.82	8.83
	1900	0.41	12.20	0.95	11.64	0.94	11.14	0.77	12.20
18	0100	0.35	11.64	0.87	12.20	0.90	12.20	0.80	11.64
	0700	0.31	12.20	0.82	11.64	0.88	11.64	0.64	12.20
	1300	0.29	11.14	0.62	11.14	0.64	12.20	0.59	11.14
	1900	0.31	11.64	0.57	11.64	0.77	11.64	0.61	11.14
19	0100	0.26	10.66	0.56	11.14	0.63	10.66	0.58	10.66
	0700	0.23	11.14	0.52	11.14	0.60	11.64	0.48	11.14
	1300	0.48	3.51	0.65	11.14	0.62	3.61	0.67	10.24
	1900	0.31	11.14	0.53	10.66	0.66	11.14	0.53	11.64
20	0100	0.23	11.14	0.51	10.66	0.59	10.24	0.49	10.66
	0700	0.24	11.14	0.48	10.66	0.50	10.66	0.44	11.14
	1300	0.33	10.66	0.50	9.84	0.53	10.66	0.54	10.24
	1900	0.31	10.24	0.46	10.66	0.52	10.66	0.51	10.24
21	0100	0.26	10.66	0.45	9.84	0.50	10.66	0.49	8.83
	0700	0.27	10.24	0.42	9.84	0.46	9.84	0.44	10.24
	1300	0.25	9.84	0.39	10.24	0.43	9.48	0.39	9.84
	1900	0.24	9.14	0.42	9.84	0.41	10.66	0.43	8.83
22	0100	0.29	3.82	0.51	10.24	0.48	10.24	0.52	8.26
	0700	0.21	10.66	0.40	8.26	0.44	11.14	0.48	9.84
	1300	0.23	11.64	0.43	11.64	0.41	11.14	0.56	10.66
	1900	0.27	11.64	0.47	11.14	0.41	11.14	0.74	10.66
23	0100	0.20	10.66	0.38	11.14	0.32	11.14	0.60	11.14
	0700	0.16	11.14	0.27	10.66	0.35	11.14	0.42	10.24
	1300	1.06	4.66	1.01	4.92	0.66	4.83	1.14	4.92
	1900	0.89	4.83	1.00	4.83	0.62	5.33	1.13	5.12
24	0100	0.89	5.33	0.93	5.33	0.69	4.92	1.00	5.22
	0700	0.89	5.45	1.10	4.20	0.65	4.13	1.10	5.45
	1300	0.93	5.12	1.03	5.45	0.66	5.33	1.04	5.22
	1900	0.56	5.56	0.74	5.56	0.52	5.82	0.77	5.45
25	0100	0.52	5.45	0.58	5.69	0.49	5.69	0.65	6.09
	0700	0.49	5.12	0.65	4.92	0.52	4.83	0.70	4.92
	1300	0.51	3.16	0.68	3.08	0.48	3.24	0.66	3.16
	1900	0.34	3.41	0.44	3.28	0.46	3.46	0.64	9.84
26	0100	0.32	3.20	0.54	10.66	0.51	11.14	0.50	9.48
	0700	0.26	10.24	0.42	10.66	0.52	11.14	0.45	9.48
	1300	0.40	2.56	0.59	10.24	0.53	10.66	0.57	10.24
	1900	0.32	10.24	0.53	9.84	0.55	9.84	0.54	9.84
27	0100	0.36	9.84	0.52	9.84	0.60	10.24	0.54	9.84
	0700	0.26	10.66	0.53	9.48	0.56	9.84	0.49	9.48
	1300	0.21	11.14			0.41	9.48	0.40	9.48
	1900	0.26	10.66			0.46	9.84	0.58	9.48
28	0100	0.24	10.66			0.45	10.24	0.59	9.14
	0700	0.21	9.14			0.43	9.84	0.45	10.24
	1300	0.24	4.27			0.44	10.24	0.43	9.84
	1900	0.29	10.66			0.48	8.83	0.55	8.83
29	0100	0.24	6.09			0.41	9.14	0.53	9.84
	0700	0.30	7.53			0.50	7.76	0.56	6.92
	1300	0.32	6.09			0.42	9.84	0.51	9.14
	1900	0.33	7.11			0.47	6.92	0.50	6.92
30	0100	0.35	6.57			0.46	9.84	0.52	8.26
	0700	1.08	4.83			0.76	4.74	1.25	4.83
	1300	0.84	4.41			0.61	4.83	1.11	4.66
	1900	0.63	4.92			0.55	4.34	0.92	5.22
31	0100	0.58	5.45			0.52	4.41	0.77	5.56
	0700	0.52	5.02			0.45	3.37	0.71	5.33
	1300	0.50	4.49			0.52	9.14	0.76	8.00
	1900	0.37	4.83			0.60	9.14	0.74	4.49
Mean		0.52	8.33	0.73	8.73	0.73	8.77	0.82	8.13
Std dev		0.34	3.13	0.39	2.52	0.45	2.77	0.42	2.32

* Electronic problems

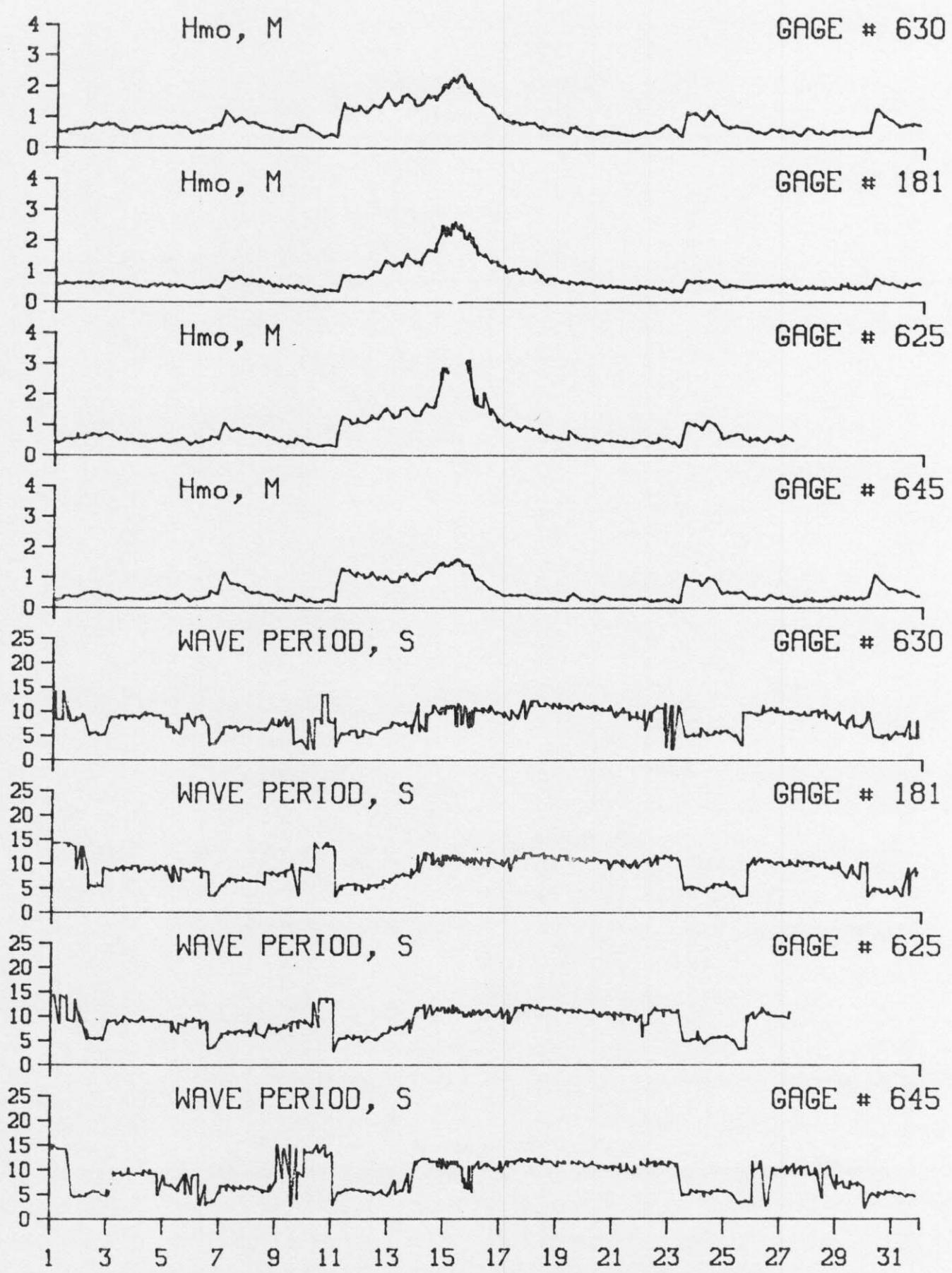


FIGURE 3. Time History of Wave Heights and Periods - August 1987.

IV. CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, alongshore currents flow either toward 340 (i.e. northward) or toward 160 (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second.

TABLE 4: Current Data
AUG 1987

Day	Alongshore Cross-shore Resultant Time	Pier Measurements				Beach Measurements (500m Updrift)				Current Meter at South Tripod			
		Dye at (579 m) Speed	Dye at (surface) Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	Depth -4.8m (NGVD) ID #679	Speed	Dir
1	0100-Along Cross Result												
1	0700-Along Cross Result	24 9 26	N off 359	165	24 6 25	N off 354		South	40	N			
1	1300-Along Cross Result												
1	1900-Along Cross Result												
2	0100-Along Cross Result												
2	0700-Along Cross Result	0 0 0	0	0	0 0 0	0		South	22	N			
2	1300-Along Cross Result												
2	1900-Along Cross Result												
3	0100-Along Cross Result												
3	0700-Along Cross Result	10 18 20	N off 40	152	44 13 45	N on 323		South	19	N			
3	1300-Along Cross Result												Inoperative
3	1900-Along Cross Result												
4	0100-Along Cross Result												
4	0700-Along Cross Result	305 0 835	N 91	165	38 48 61	N on 289		South	15	N			
4	1300-Along Cross Result												
4	1900-Along Cross Result												
5	0100-Along Cross Result												
5	0700-Along Cross Result	0 15 15	N on 250	177	27 27 37	N on 295		South	11	N			
5	1300-Along Cross Result												
5	1900-Along Cross Result												

KEY = All speeds in CM/SEC

N = Northward, Shore parallel

S = Southward, Shore parallel

TABLE 4: Current Data
AUG 1987

Day	Time	Pier Measurements				Beach Measurements			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679 Speed Dir	
		Alongshore Cross-shore Resultant		Dye at (579 m) surface	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed
6	0100-Along Cross Result									
6	0700-Along Cross Result	55 0	S	165		8 0	S		33	S
6	1300-Along Cross Result	55	160			8 8	160			
6	1900-Along Cross Result									
7	0100-Along Cross Result									
7	0700-Along Cross Result	30 12 33	S on 182	152		25 0 25	S 160		59	S
7	1300-Along Cross Result									
7	1900-Along Cross Result									
8	0100-Along Cross Result									
8	0700-Along Cross Result	30 8 31	S on 174	201		14 8 16	S on 191	North	18	S
8	1300-Along Cross Result									
8	1900-Along Cross Result									
9	0100-Along Cross Result									
9	0700-Along Cross Result	41 10 42	N off 354	201		10 3 11	N off 357	South	20	N
9	1300-Along Cross Result									
9	1900-Along Cross Result									
10	0100-Along Cross Result									
10	0700-Along Cross Result	7 5 9	N on 303	152		7 2 7	N on 326	South	20	
10	1300-Along Cross Result									
10	1900-Along Cross Result									

KEY = All speeds in CM/SEC

N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

TABLE 4: Current Data
AUG 1987

Day	Alongshore Cross-shore Resultant Time	Pier Measurements				Beach Measurements (500m Updrift)				Current Meter at South Tripod	
		Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Depth -4.8m (NGVD) ID #679	Speed
11 0100	Along Cross Result										
11 0700	Along Cross Result	41 10 42	S on 174	152	122 61 136	S on 187	North	58	S		
11 1300	Along Cross Result										
11 1900	Along Cross Result										
12 0100	Along Cross Result										
12 0700	Along Cross Result	30 0 31	S on 160	152	30 30 43	S on 205	North	46	S		
12 1300	Along Cross Result										
12 1900	Along Cross Result										
13 0100	Along Cross Result										
13 0700	Along Cross Result	20 10 23	S on 187	165	61 0 61	N 340	South	46	N		
13 1300	Along Cross Result										
13 1900	Along Cross Result										
14 0100	Along Cross Result										
14 0700	Along Cross Result	14 7 15	S on 187	226	5 8 9	N off 36	South	41	N	Gage Imperative	
14 1300	Along Cross Result										
14 1900	Along Cross Result										
15 0100	Along Cross Result										
15 0700	Along Cross Result	20 0 20	N 340	262	87 0 87	N 340	South	63	S		
15 1300	Along Cross Result										
15 1900	Along Cross Result										

KEY = All speeds in CM/SEC

N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

TABLE 4: Current Data
AUG 1987

Day	Alongshore Cross-shore Resultant Time	Pier Measurements						Beach Measurements			Current Meter at South Tripod			
		Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	(500m Updrift)	Dye 12m offshore (surface)	Location	Speed	Dir	Depth -4.8m (NGVD) ID #679
16	0100-Along Cross Result													
16	0700-Along Cross Result	17 0	N		213		87 22 90	N on 326		South	25	N		
16	1300-Along Cross Result													
16	1900-Along Cross Result													
17	0100-Along Cross Result													
17	0700-Along Cross Result	8 8 11	N off 25		262		61 61 86	N on 295		North	5	S		
17	1300-Along Cross Result													
17	1900-Along Cross Result													
18	0100-Along Cross Result													
18	0700-Along Cross Result	24 6 25	N off 354		177		122 30 126	N off 354		North	3	S		
18	1300-Along Cross Result													
18	1900-Along Cross Result													
19	0100-Along Cross Result													Gage Inoperative
19	0700-Along Cross Result	12 12 17	N on 295		165		51 25 57	N off 7		South	15	N		
19	1300-Along Cross Result													
19	1900-Along Cross Result													
20	0100-Along Cross Result													
20	0700-Along Cross Result	17 4 17	S off 146		165		5 5 7	N on 295		North	51	S		
20	1300-Along Cross Result													
20	1900-Along Cross Result													

KEY = All speeds in CM/SEC

N = Northward, Shore parallel

S = Southward, Shore parallel

on = onshore off = offshore

TABLE 4: Current Data
AUG 1987

Day	Alongshore Cross-shore Resultant Time	Pier Measurements				Beach Measurements				Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
		Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir
21 0100	-Along Cross Result											
21 0700	-Along Cross Result	30 0 30	S off 160		140	20 10 23	S off 133		North	9	N	
21 1300	-Along Cross Result											
21 1900	-Along Cross Result											
22 0100	-Along Cross Result											
22 0700	-Along Cross Result	3 10 11	N off 52		152	38 0 38	N 340		South	18	N	
22 1300	-Along Cross Result											
22 1900	-Along Cross Result											
23 0100	-Along Cross Result											
23 0700	-Along Cross Result	20 5 21	S off 146		140	5 1 5	S off 146		North	18	S	Gage Imperative
23 1300	-Along Cross Result											
23 1900	-Along Cross Result											
24 0100	-Along Cross Result											
24 0700	-Along Cross Result	28 0 28	S off 160		165	20 15 25	S on 197		North	10	S	
24 1300	-Along Cross Result											
24 1900	-Along Cross Result											
25 0100	-Along Cross Result											
25 0700	-Along Cross Result	4 4 5	S on 205		152	20 25 33	N on 289		South	13	N	
25 1300	-Along Cross Result											
25 1900	-Along Cross Result											

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

TABLE 4: Current Data
AUG 1987

Day	Time	Pier Measurements						Beach Measurements			Current Meter at South Tripod	
		Alongshore Cross-shore Resultant		Dye at (579 m) surface	Distance from Baseline (m)	Dye at Mid-Surf Zone (surface)		(500m Updrift)	Dye 12m offshore (surface)	Location	Speed	Dir
26	0100-Along Cross Result											
26	0700-Along Cross Result			5 5 7	N on 298	152	12 0 12	N 340		South	13	S
26	1300-Along Cross Result											
26	1900-Along Cross Result											
27	0100-Along Cross Result											
27	0700-Along Cross Result			36 11 37	N off 357	140	38 19 43	N off 7		South	9	N
27	1300-Along Cross Result											
27	1900-Along Cross Result											
28	0100-Along Cross Result											
28	0700-Along Cross Result			3 8 8	S off 88	140	18 13 22	N off 17		South	14	N
28	1300-Along Cross Result											
28	1900-Along Cross Result											
29	0100-Along Cross Result											
29	0700-Along Cross Result			17 17 25	S off 115	140	3 0 3	N 340		South	8	N
29	1300-Along Cross Result											
29	1900-Along Cross Result											
30	0100-Along Cross Result											
30	0700-Along Cross Result			30 8 31	S on 174	152	47 12 48	S off 146		North	46	S
30	1300-Along Cross Result											
30	1900-Along Cross Result											

KEY = All speeds in CM/SEC

N = Northward, Shore parallel

S = Southward, Shore parallel

on = onshore off = offshore

TABLE 4: Current Data
AUG 1987

Day	Time	Pier Measurements				Beach Measurements				Current Meter				
		Alongshore Cross-shore Resultant	Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	(500m Updrift)	Location	Speed	Dir	at South Tripod Depth -4.8m (NGVD) ID #679
31	0100-Along Cross Result													
31	0700-Along Cross Result		3 9 10	N on 268		140		24 6 25	N on 326		South	18	S	
31	1300-Along Cross Result													
31	1900-Along Cross Result												Gage Inoperative	

KEY = All speeds in CM/SEC
 N = Northward, Shore parallel
 S = Southward, Shore parallel
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V. SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) taken at the seaward end of the pier are made of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves) but not surface chop or capillary waves. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring alignment of the wave crests. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 east of true north; consequently, wave angles greater than 70 imply the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are made daily at the seaward end of the FRF pier. A jar along with a thermometer is lowered about .3 m (1 ft) into the water and allowed to remain for at least one minute. The jar is removed, the temperature read and a hydrometer is used to determine the density. A secci disc is used to determine the surface visibility.

TABLE 5

SUPPLEMENTAL OBSERVATIONS

AUG 1987

DAY	TIME	WAVE APPROACH ANGLE AT PIER END deg from True N		RADAR WAVE ANGLE deg from True N	WIDTH OF SURF ZONE(m)	WATER CHARACTERISTICS AT PIER END		
		Primary	Secondary			TEMP(C)	DENSITY (g/cc)	SECCI VIS(m)
1	1035	none	visible	80	33	26.0	1.0212	4.6
2	1100	55		80	54	25.0	1.0200	3.4
3	940	100			44	21.1	1.0216	3.4
4	745	120			40	19.2	1.0223	2.4
5	819	110		90	49	26.0	1.0206	7.0
6	722	100	30	90	30	25.1	1.0207	4.3
7	708	35		inoperative	49	25.3	1.0206	3.0
8	825	50			45	26.1	1.0200	5.5
9	1020	none	visible		59	26.9	1.0202	0.0
10	900	110			6	18.0	1.0236	7.9
11	745	45			61	19.4	1.0226	4.3
12	810	40			61	23.0	1.0210	4.3
13	750	70			76	24.2	1.0200	4.0
14	600	70			128	24.7	1.0200	0.9
15	815	80			201	25.0	1.0200	0.6
16	830	80			134	25.3	1.0207	1.5
17	550	85	75		158	25.0	1.0206	0.6
18	730	85			80	25.3	1.0209	1.2
19	810	85			49	26.4	1.0202	4.3
20	900	90			49	25.8	1.0202	1.5
21	815	70			29	26.6	1.0194	5.5
22	800	90			40	26.6	1.0200	3.7
23	800	95			15	20.0	1.0225	4.9
24	1122	40		80	79	23.9	1.0214	4.0
25	830	70		50	38	24.1	1.0202	4.3
26	815	85			34	24.4	1.0207	4.3
27	721	none	visible	80	24	24.7	1.0206	3.0
28	720	100		80	27	28.6	1.0210	2.1
29	840	60	95		30	23.4	1.0216	1.8
30	1010	40		45	56	25.0	1.0204	2.4
31	920	70			67	25.5	1.0206	3.0

VI. WATER LEVELS

The National Ocean Services (NOS) has established a primary tide station (No. 865-1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect data every 6 minutes throughout the month.

Figure 4 shows the variation in mean water levels computed over a tidal cycle period (12.42 hours), and contains a list of selected mean and extreme values. This presentation is useful in identifying effects on both meteorological and astronomical forces on the open coast water levels.

Table 6 contains the time of the center of each sampling interval and the range, high, low, and mean water levels during each tidal cycle.

FRF TIDE HEIGHTS
AUG 1987

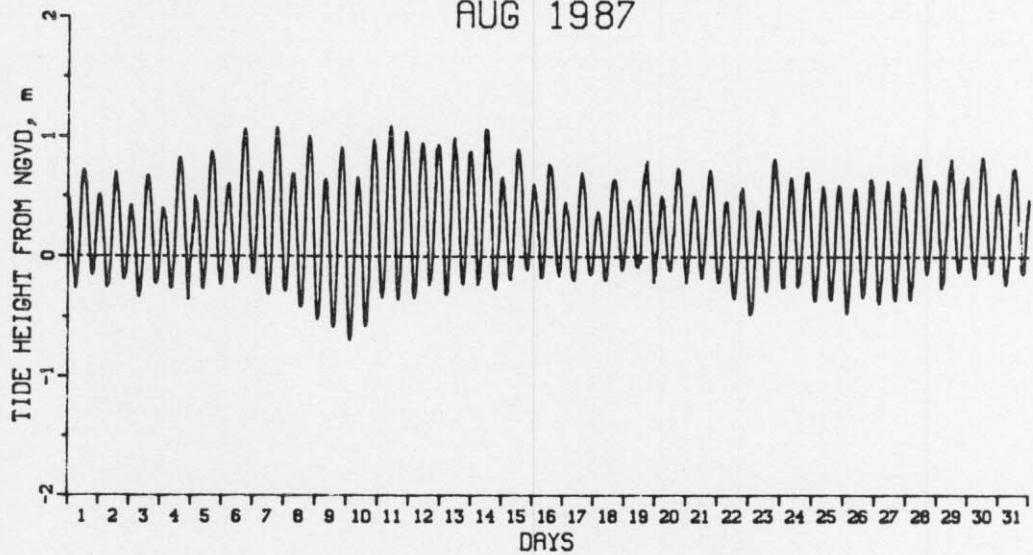


FIGURE 4. Time History of Mean Water Levels, August 1987

MONTHLY WATER LEVELS (METERS NGVD)

EXTREME LOW =	-0.69	ON DAY 10 AT	148HRS.
EXTREME HIGH =	1.09	ON DAY 11 AT	900HRS.
MONTHLY MEAN =	0.23		
MEAN LOW =	-0.27		
MEAN HIGH =	0.81		
MEAN RANGE =	1.08		

Table 6: WATER LEVELS (METERS NGVD)

MID-CYCLE DAY	TIME	LOW	HIGH	MEAN	RANGE
1	612	-0.26	0.72	0.21	0.98
1	1837	-0.15	0.66	0.23	0.81
2	703	-0.25	0.70	0.17	0.95
2	1928	-0.19	0.61	0.18	0.80
3	753	-0.33	0.67	0.12	1.00
3	2018	-0.22	0.66	0.15	0.88
4	843	-0.26	0.82	0.20	1.08
4	2109	-0.35	0.79	0.23	1.14
5	934	-0.27	0.88	0.23	1.14
5	2159	-0.23	0.87	0.26	1.09
6	1024	-0.21	1.05	0.32	1.26
6	2249	-0.13	1.07	0.39	1.20
7	1115	-0.31	1.08	0.29	1.39
7	2340	-0.28	1.07	0.31	1.35
8	1205	-0.41	1.01	0.22	1.42
9	30	-0.52	1.01	0.17	1.52
9	1255	-0.58	0.88	0.10	1.46
10	121	-0.69	0.91	0.05	1.61
10	1346	-0.57	0.97	0.12	1.54
11	211	-0.34	1.05	0.33	1.39
11	1436	-0.35	1.09	0.37	1.45
12	301	-0.34	1.05	0.34	1.38
12	1527	-0.23	0.95	0.37	1.18
13	352	-0.31	0.97	0.32	1.28
13	1617	-0.23	0.99	0.35	1.22
14	442	-0.23	1.06	0.39	1.29
14	1707	-0.27	1.06	0.33	1.33
15	532	-0.19	0.89	0.29	1.08
15	1758	-0.11	0.90	0.34	1.01
16	623	-0.17	0.77	0.25	0.94
16	1848	-0.16	0.76	0.26	0.92
17	713	-0.20	0.68	0.17	0.87
17	1938	-0.15	0.70	0.21	0.85
18	804	-0.19	0.62	0.15	0.81
18	2029	-0.11	0.65	0.25	0.75
19	854	-0.08	0.69	0.25	0.78
19	2119	-0.21	0.87	0.28	1.08
20	944				
20	2210	-0.21	0.74	0.25	0.95
21	1035	-0.17	0.68	0.22	0.86
21	2300	-0.21	0.73	0.21	0.94
22	1125	-0.34	0.54	0.09	0.88
22	2350	-0.47	0.58	0.00	1.05
23	1216	-0.28	0.80	0.19	1.09
24	41	-0.25	0.82	0.26	1.07
24	1306	-0.25	0.70	0.24	0.95
25	131	-0.36	0.71	0.15	1.07
25	1356	-0.35	0.60	0.13	0.95
26	222	-0.46	0.59	0.07	1.05
26	1447	-0.33	0.65	0.16	0.98
27	312	-0.38	0.64	0.13	1.02
27	1537	-0.36	0.62	0.13	0.97
28	402	-0.35	0.79	0.17	1.14
28	1628	-0.14	0.83	0.30	0.96
29	453	-0.41	0.82	0.25	1.23
29	1718	-0.12	0.75	0.27	0.87
30	543	-0.17	0.84	0.29	1.01
30	1808	-0.13	0.76	0.25	0.88
31	634	-0.23	0.74	0.21	0.97
31	1859	0.27	0.72	0.54	0.45

VII. NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Zeiss surveying system; a Zeiss Elta-2 first-order, self-recording electronic theodolite distance meter in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in July and the two surveys in August on profile line 188, located 517 m south of the pier. A small amount of erosion on the foreshore (70 to 100 m) was accompanied by a rebuilt nearshore bar and trough (100 to 230 m). Only minor changes are visible offshore.

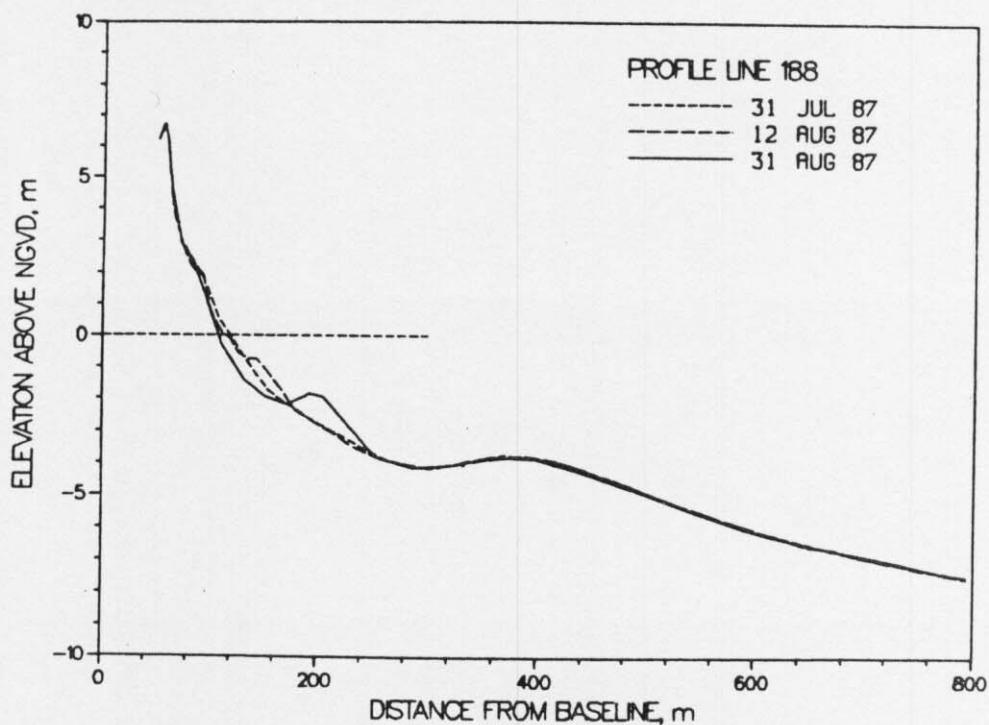


Figure 5. Monthly CRAB profiles on profile 188 - 517 meters south of pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile since the end of 1986. The one minor change (120 m) is a result of a very small nearshore bar present during the 12 August survey.

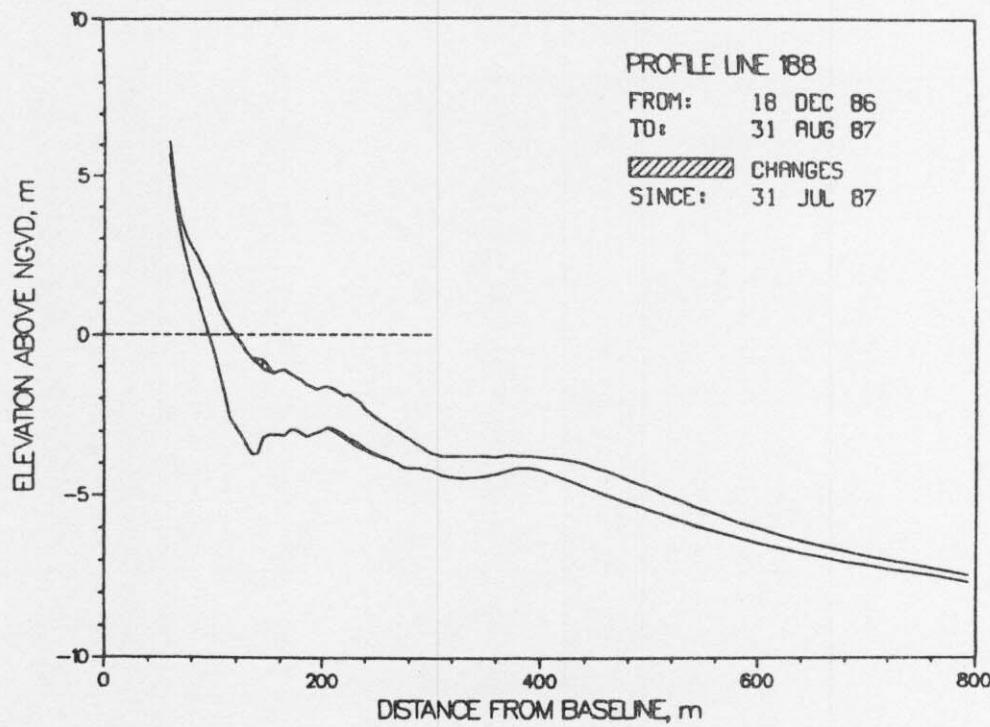


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. No bathymetric survey was conducted in August. Figure 7 is a contour map showing last month's survey for reference.

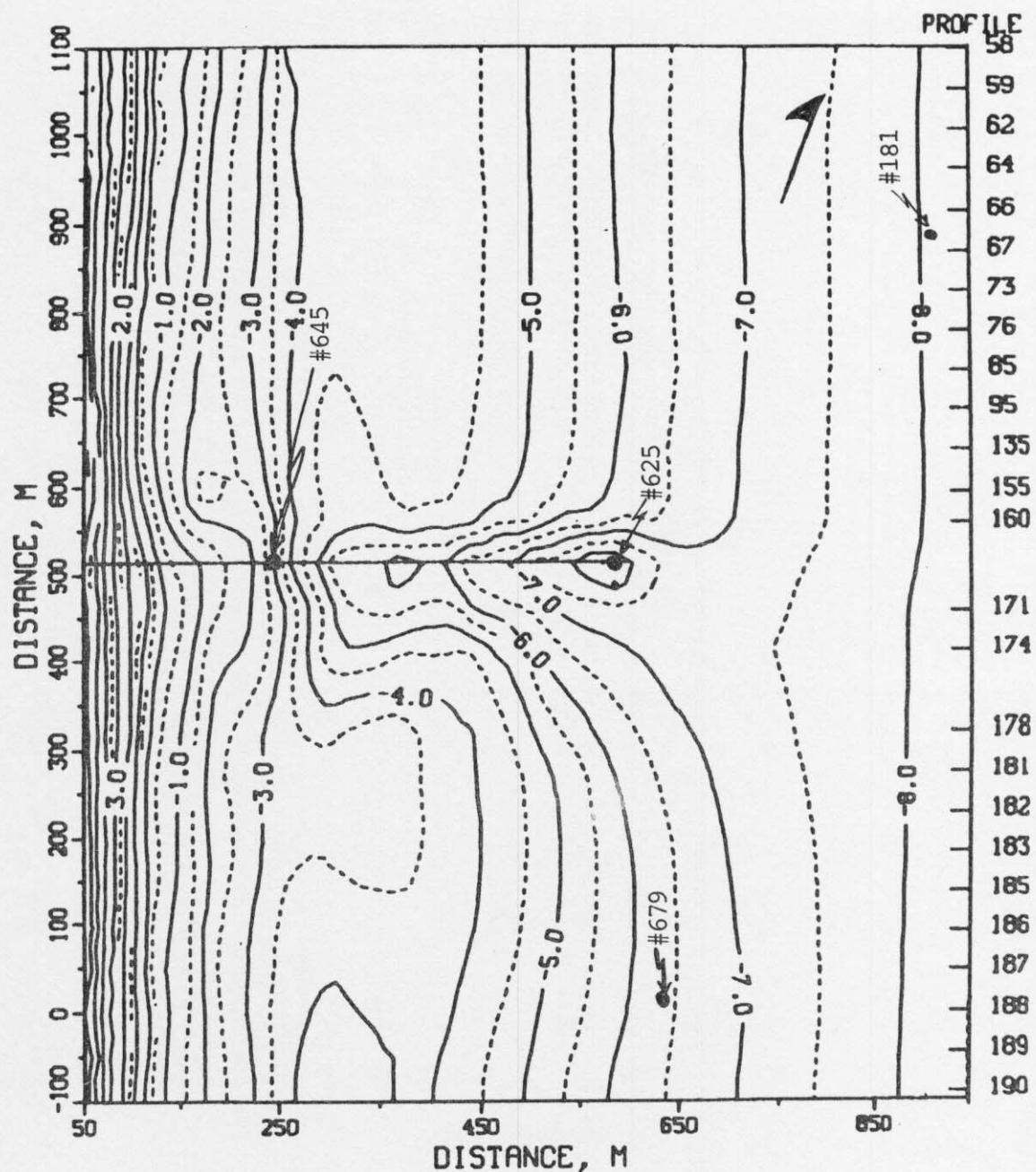


FIGURE 7. FRF BATHYMETRY 22 JUL 87
CONTOURS IN METERS

VIII. SPECIAL EVENTS

A. Storm Data Collection. The following list identifies times when the wave height at the seaward end of the pier (i.e. as measured by the Baylor Gage #625 at pier station 19+00) exceeded 2 m. When this occurred, four contiguous 34-min wave records were obtained every hour:

<u>Start</u>	<u>End</u>
14 Aug (1900)	16 Aug (0842)

B. Storm Synopsis.

14-16 August: Onshore winds generated by a Canadian high pressure system first affected the FRF on 11 August. Augmented by a weak storm which developed off Florida's east coast on 14 August, onshore winds continued through 16 August. Maximum wind speeds exceeding 10 m/s (NE) and Hmo at Gage #181 of 2.60 m ($T_p = 11.13$ sec) were recorded at 0700 hrs on 15 August. Because the winds were produced by a high pressure system, barometric pressure never declined and there was no precipitation.

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